Command Bird Injury Report

Final Report

Prepared for the

Command Trustee Council:

U.S. Fish and Wildlife Service
California Department of Fish and Game
National Oceanic and Atmospheric Administration
California Department of Parks and Recreation
California State Lands Commission

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Background

On the evening of September 26, 1998, the T/V Command left San Francisco Bay bound for Panama. As it traveled in the southbound traffic lane off San Francisco and San Mateo County coasts, it released an estimated 3,000 gallons of Intermediate Bunker Fuel (IBF) 380, also known as Fuel Oil No. 6. Due to light winds and fair weather, the oil moved little in the first few days, primarily staying the vicinity of the southbound traffic lane. On September 30, oil began to wash ashore, largely in the form of scattered tarballs, over 15 miles of beaches, primarily in San Mateo County (see Figure 1). Although, a tarball sample collected as far away as the Salinas River mouth in Monterey Co. matched the source sample from the tanker.

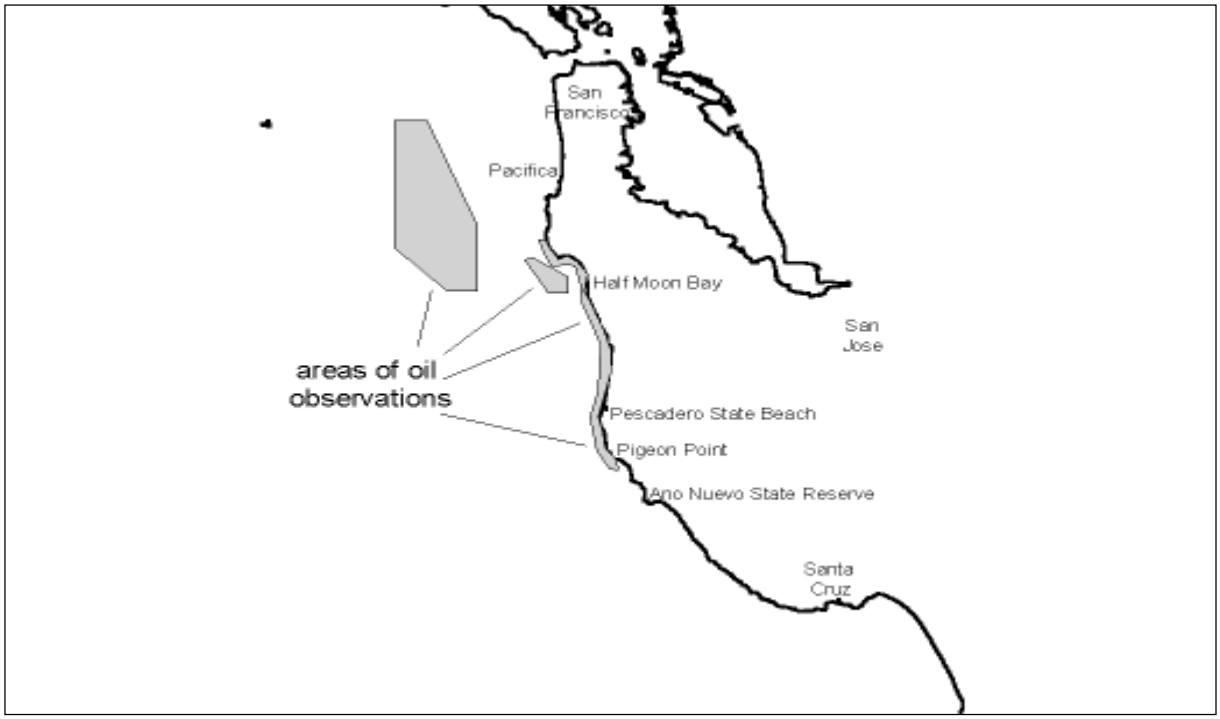

Figure 1- Area of oil observations during the Command Oil Spill

The primary impacts from the spill were: 1) injuries to large numbers of seabirds; 2) injuries to sandy beach and rocky intertidal shoreline habitats; and 3) lost and diminished use of beaches for human recreation. The Pathway Report (French and Isaji, 2000) describes the trajectory of the spill and its movement across the ocean to the coast.

This report provides a summary of the results of the oil spill response and survey data relating to injuries to birds. A separate report prepared by Industrial Economics (Browne et al. 2001) describes impacts to human recreational activities.

Bird Mortality

Oil is highly toxic and inflicts two kinds of harm on birds. First, many birds die from direct contact with oil, either by oil coating their feathers resulting in hypothermia, or by

ingesting oil resulting in toxicity, or by inhaling oil causing pneumonia or emphysema. Second, reproductive output suffers, both because birds that die are permanently removed from the breeding population and because the reproduction of surviving oiled birds are impaired for one or more breeding seasons.

During the spill, 171 live and dead birds were recovered from the beaches. Table 1 lists these by species, enumerating the number that died from the number that were rehabilitated and released. However, after an oil spill only fractions of the birds injured are actually recovered. Birds may be lost at sea, scavenged at sea or on shore, missed by searchers, or live debilitated birds may fly out of the search area. Many birds die at sea and sink, a few crawl into secluded spots on land. The likelihood of retrieving a carcass decreases with the decreasing body size of the bird (Carter et al. 2000). For example, deposition of murrelet carcasses on Northern California beaches is unlikely because of low onshore transport, currents, at-sea carcass sinking, and scavenging (Ford et al. 1996). Many of the animals recovered alive and subsequently cleaned at rescue centers do not survive the process or have reduced survivability once released to the wild (Sharp 1996, Anderson et al. 1996).

In the alcid family, the Marbled Murrelet (Federally Threatened Species) is one of the most threatened seabirds in the world. Due to the small size of the bird, it would be unlikely to be found dead. High levels of beach scavenging of murrelets also undoubtedly contribute to low carcass retrieval. Baseline beached bird surveys show an encounter rate of only 0.001 Marbled Murrelet carcasses per km. Only a total of six murrelet carcasses have been documented on beaches in the spill area during non-oil spill surveys from 1993 – 2000 (Roletto et al. 2001). In comparison, Common Murres, a much larger bodied and more abundant bird, are encountered in baseline surveys at a rate of 0.316 birds per km (Roletto et al. 2001) and a total of 1,332 Common Murres have been documented on beaches within the spill area during non-oil spill surveys from 1993 to 2000. In evaluating the impacts of the *M/V Kure* and the *M/V New Carissa* on Marbled Murrelet populations, Ford et al. (2000, 2002) estimated that on average only about 1 in 18 dead murrelets would be recovered. Therefore, although no Marbled Murrelets carcasses were recovered during the spill response (see Table 1), it is reasonable to assume that some mortality occurred.

Table 1: Recovered Birds

SPECIES	COLLECTED DEAD	COLLECTED LIVE – DIED	COLLECTED LIVE - RELEASED	TOTAL
Common Loon	1	0	0	1
Pacific Loon	1	0	0	1
Western Grebe	1	0	0	1
Eared Grebe	1	0	0	1
Sooty Shearwater	11	0	1	12
shearwater, sp.	1	0	0	1
Double-cr. Cormorant	1	0	0	1
Brandt's Cormorant	1	0	0	1
cormorant, sp.	1	0	0	1
Brown Pelican	4	2	4	10
Surf Scoter	1	0	0	1
Common Moorhen	1	0	0	1
Wandering Tattler	1	0	0	1
Western Gull	3	0	2	5
Glaucous-winged x Western Gull	0	1	0	1
California Gull	2	0	0	2
Common Murre	64	35	30	129
unknown	1	0	0	1
TOTAL	**96**	**38**	**37**	**171**

Wildlife Reconnaissance Surveys

During the spill response, the Trustees conducted three forms of surveys: 1) aerial surveys for resources at risk at sea; 2) boat surveys for resources at risk and the collection of injured and dead specimens (specific focus on Marbled Murrelets) and 3) shoreline surveys for oiled wildlife, resources at risk and the collection of injured or dead specimens. The purpose of these surveys was not only to collect oiled wildlife but also to identify resources that were potentially in the path of the oil or wildlife that were oiled but still mobile.

Aerial Survey Results

The aerial surveys were conducted on four consecutive days: September 29, September 30, October 1, and October 2. All of the flights covered transects of ocean between Pt. Santa Cruz and Pacifica. The intent was to identify and quantify the numbers of seabirds and other wildlife that were potentially in the path of the oil. Table 2 below provides a brief summary of the results. The survey results and maps showing the trajectory of the

spill demonstrate that a large numbers of seabirds were in the vicinity of the spill and at risk as it moved through the area.

Table 2: Aerial Survey Results
absolute count and density per km^2 (in parenthesis)

	SEPT 29	SEPT 30	OCT 1	OCT 2
area sampled:	25.3 km^2	26.3 km^2	30.7 km^2	40.8 km^2
SPECIES				
Western Grebe	2 (0.08)	124 (4.71)	124 (4.04)	44 (1.08)
Sooty Shearwater	8,760 (346.25)	7,371 (280.27)	2,241 (73.00)	478 (11.72)
Brandt's Cormorant	20 (0.79)	40 (1.52)	159 (5.18)	12 (0.29)
Brown Pelican	14 (0.55)	12 (0.46)	19 (0.62)	153 (3.75)
all gull species	522 (20.63)	844 (32.09)	314 (10.23)	1,737 (42.57)
Common Murre	113 (4.47)	226 (8.59)	621 (20.23)	1,748 (42.84)
Marbled Murrelet	1 (0.04)	9 (0.34)	11 (0.36)	12 (0.29)
all others	14 (0.55)	176 (6.69)	115 (3.75)	93 (2.28)
TOTAL:	**9,446** **(373.36)**	**8,802** **(334.68)**	**3,604** **(117.39)**	**4,277** **(104.83)**

Other species observed during the aerial surveys but not listed in Table 2 include Pacific Loon, Northern Fulmar, Buller's Shearwater, Pink-footed Shearwater, Black-vented Shearwater, Gadwall, White-winged Scoter, Surf Scoter, Red Phalarope, Pomarine Jaeger, Elegant Tern, Common Tern, Cassin's Auklet, and Rhinoceros Auklet. Other gull species include California, Herring, Western, and Sabine's Gulls.

Boat Survey Results

Two near-shore boat surveys were conducted, primarily to identify at risk Marbled Murrelets and other bird species. The first survey was conducted on September 30. The survey began at Princeton Harbor and ended off Greyhound Rock (south of Ano Nuevo Island). It included two sets of 100 meter wide transects centered around 400 meters and 800 meters offshore. A total of 51 Marbled Murrelets were observed (29 on the 400 m transect and 22 on the 800 m transect, see Figure 2 for a map of exact locations).

The second boat survey was conducted on October 2, during the period when oil was coming ashore. The survey began at Pillar Point Harbor and ended at Soquel Point (in Santa Cruz). Only one transect was done, with a width of 200 meters and centered 400 meters from shore. A total of 21 Marbled Murrelets were counted during the survey, all in groups of two with one group of three (see figure 2 for exact locations). Oil globs and sheening were observed twice, near Eel and Seal Rocks, not far from four of the Marbled Murrelets. Table 3 lists all of the wildlife observed during the second boat survey.

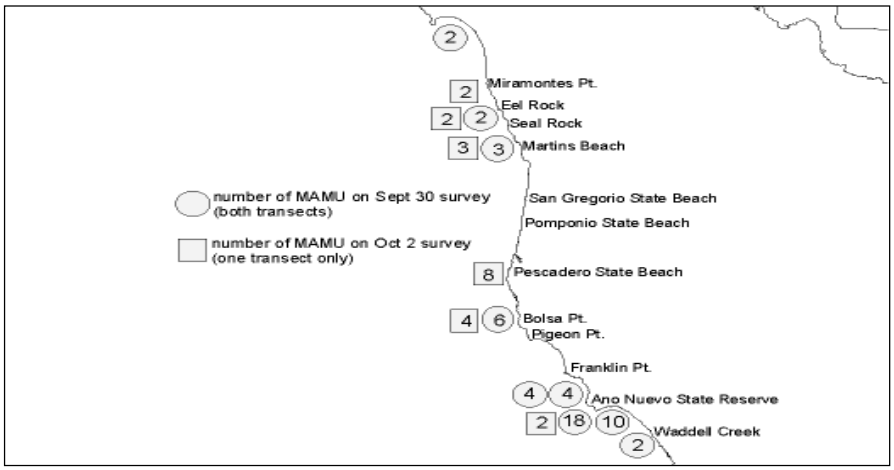

Figure 2-Exact locations of observed Marbled Murrelets

Table 3: October 2 Boat Survey Results
400 meter from shore transect

SPECIES	OBSERVATIONS
Common Loon	4 single individuals
Western Grebe	group of 150, group of 60, and a total of 25 in smaller groups; nearly all from Pescadero State Beach north
Sooty Shearwater	group of 2,000 near Half Moon Bay and group of several hundred near Pescadero
Brown Pelican	group of 50 near Seal Rock and a total of 16 in smaller groups, plus 250 on shore at Ano Nuevo.
cormorant, sp.	28 individuals, mostly south of Ano Nuevo
Surf Scoter	19 individuals, all near San Gregorio State Beach
Common Murre	group of several hundred near Pescadero and a total of 17 in smaller scattered groups, mostly to the south
Marbled Murrelet	21 individuals in 10 groups from Eel Rock to Ano Nuevo

Shoreline Survey Results

During the spill response, several shoreline surveys were conducted to locate oiled dead and injured wildlife and to determine the locations of wildlife that may be at risk from the spill. These surveys included general searches of the beaches for all wildlife and a specific survey for Snowy Plovers.

Personnel involved in the Apex Houston Common Murre Restoration Project, personnel from the Gulf of the Farallones Marine Sanctuary, and personnel from International Bird Rescue conducted several days of shoreline surveys. On September 29, beaches from Linda Mar Beach in Pacifica to Pescadero State Beach were searched. On September 30 and October 1, selected beaches from Pacifica to Gazos Greek were searched. These surveys were responsible for finding many of the birds listed in Table 1, in addition to documenting the presence of several oiled but free flying birds and identifying large numbers of seabirds who were at risk of being impacted. These surveys documented the following free flying oiled wildlife: five Brown Pelicans, two Common Murres, one Western Gull and one Heermann's Gull. The surveys also identified 27 bird species present on the beaches in the area of the spill. Appendix 1 documents in detail the resources at risk that were identified in these surveys.

In addition to the surveys discussed above, on October 1 through October 3, Douglas George of the Point Reyes Bird Observatory conducted surveys for Snowy Plovers. The surveys included selected beaches in San Mateo and northern Santa Cruz Counties. George (1998) provides a detailed report of his results. In all, 125 Snowy Plovers were observed (though some are known by their bands to have been counted twice) and none were visibly oiled. The report also provides observations of other birds at the surveyed beaches.

Total Bird Mortality

The Trustees employed a model to obtain an estimate of the total bird mortality caused by the Command Spill. By analyzing the aerial surveys conducted during the spill and accounting for the amount of coastline inaccessible to searchers and carcass recovery rates documented in other spills, the model estimated that 11,193 Common Murres were a risk during the spill and that a total of 1,490 murres were killed. The model also estimated that 87 murrelets were at risk during the spill and that 12 murrelets were killed (by assuming that the proportion of Marbled Murrelets within the affected area that die as a result of oil exposure is the same as the proportion of Common Murres). For more information on this model please see the Ford 2002 Report entitled *Estimated Common Murre and Marbled Murrelet Mortality Resulting from the Command Spill*, which is attached as an appendix to this document.

Conclusion

In conclusion, Federal and State agencies involved in the spill response believe that thousands of seabirds were impacted during this oil spill, as the birds collected during the spill represent only a fraction of the birds injured. Injured birds included several California Brown Pelicans and Marbled Murrelets, both listed as threatened and/or endangered species under the Endangered Species Act. The Federal and State agencies responsible for restoring the injured resources from this spill have determined that seabirds, primarily Common Murres, suffered the greatest injury as a result of the spill. Therefore, the restoration money will primarily be used for projects benefiting seabirds.

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Appendix A- Results of Shoreline Surveys for Resources at Risk

Date	Location	Survey Results	Notes
29 Sep	Linda Mar Beach	102 HEEG 9 WEGU 3 WILL 2 GRYE	
29 Sep	San Pedro Rock	61 BRCO 57 BRPE 23 Gull Sp.	
29 Sep	Devil's Slide Rock	56 BRCO 2 WEGU 1 BRPE	
29 Sep	Grey Whale Beach	100 BRPE 502 HEEG 103 WEGU 6 MAGO 1WHIM 2 WILL	
29 Sep	Moss Beach	12 BRCO 2 WEGU	small beach just north of Marine Reserve
29 Sep	Pillar Point Harbor North Beach	15 WEGU 1 HEEG 4 WILL 76 SAND 1 BRCO 55 RUTU	
29 Sep	Pillar Point Harbor	38 HEEG 131 WEGU 19 BRPE 1 LEYE 2 KILL 1 COEG 40 SAND 62 WILL 2 WHIM 7 BLTU (on water) 4 HEEG 34 WEGU 14 BRPE	
29 Sep	Pillar Point Harbor	6,000++ SOSH (on water)	
29 Sep	Beach North of Pescadero	45 HEEG 3 WILL 2 SUSC	inaccessible, scanned from road

Date	Location	Survey Results	Notes
29 Sep	Pescadero Beach	20 WHIM 26 WILL 3 BLTU 1 CORA 78 WEGU 10 BRCO 23 BRPE 7 HEEG 40 SAND 2 BLOY	
29 Sep	Pomponio Beach	168 HEEG 76 WEGU 54 WILL 1 KILL 6 SAND 1 WHIM 1 CORA 49 SUSC (on water)	
29 Sep	San Gregorio Beach	245 HEEG 144 WEGU 43 WILL 15 MAGO 3 WHIM 35 SAND 43 SUSC (on water)	
30 Sep	Linda Mar Beach	19 HEEG 5 MAGO 3 SNPL 3 WEGU 1 WILL	
30 Sep	Shelter Cove	4 MAGO 12 WEGU	scanned from above
30 Sep	San Pedro Rock	200 BRPE 300 BRCO	
30 Sep	Devil's Slide Rock	140 BRCO 200 SOSH (on water) 2 BLOY 4 WEGU 1 HEEG	
30 Sep	Grey Whale Beach	200 HEEG 150 WEGU 50+ BRPE	
30 Sep	Montara Beach	29 HEEG 2 CORA 1 WEGU 1 WILL 41 SUSC (on water)	

Date	Location	Survey Results	Notes
30 Sep	Fitzgerald Marine Reserve	2 BLTU 6 DCCO 12 BRCO 120 HEEG 50 GAGU 1 BLOY 11 WILL 5 MAGO 1 BCNH 4 SNPC 24 BLTU 1 GBHE 100+ SOSH (on water)	
30 Sep	Pillar Point Harbor North Beach	1 BLTU 1 WILL (on water) 1 WEGU 1 BRPE	
30 Sep.	Pillar Point Harbor	6 WILL 14 HEEG 1 WEGU 2 CORA 23 SAND 5 SUSC (on water)	
30 Sep.	Redondo Beach	3 WILL 6 WEGU 2 HEEG 1 BLOY 7 BLTU 5 RUTU	
30 Sep	San Gregorio Beach	19 SAND 11 MAGO 56 HEEG 3 WILL 2 WHIM	
Oct 1	Linda Mar Beach	80 HEEG 4 MAGO 3 WILL 5 CAGU 2 TUVU	
Oct 1	Devil's Slide Rock	160 BRCO 4 HEEG 2 WEGU 1 BLOY	
Oct 1	Grey Whale Beach	140 BRPE 300+ HEEG 130 WEGU 6 BRPE 30 BRCO 4 HEEG 3 WEGU	

Date	Location	Survey Results	Notes
Oct 1	Montara State Beach	23 HEEG 3 WEGU 4 CAGU 2 GWGU 1 WILL 2 SAND 1 WHIM 25 SUSC (on water)	
Oct 1	Fitzgerald Marine Reserve	100 HEEG 52 WEGU 4 CAGU 5 BRCO 9 DCCO 4 PECO 4 GWGU 31 SAND 21 WILL 15 BLTU 24 BBPL 2 MAGO 1 SPSA 4 WHIM 2 BLOY 2 GBHE	
Oct. 1	Pillar Point Fishing Pier	100 WEGU 3 BRPE	

Species Code-
BBPL-Black-bellied Plover, BLOY-Black Oystercatcher, BLTU-Black Turnstone,
BRCO-Brandt's Cormorant, BRPE-Brown Pelican, CAGU-California Gull,
COEG-Common Egret, CORA-Common Raven, DCCO-Double-Crested Cormorant,
GBHE-Great Blue Heron, GWGU-Glaucous-winged Gull, GRYE-Greater Yellowlegs,
HEEG-Heerman's Gull, KILL-Killdeer, LEYE-Lesser Yellowlegs, MAGO-Marbled Godwit,
PECO-Pelagic Cormorant, RUTU-Ruddy Turnstone, SAND-Sanderling, SNPL-Snowy Plover,
SOSH-Sooty Shearwater, SPSA-Spotted Sandpiper, SUSC-Surf Scooter, TUVU-Turkey Vulture,
WEGU-Western Gull, WHIM-Whimbrel, WILL-Willet

Appendix B-

FINAL REPORT

Estimated Common Murre and Marbled Murrelet Mortality Resulting from the *T/V Command* Spill

Prepared for:

Command Trustee Council:
California Department of Fish and Game Office of Spill Prevention and Response
California State Lands Commission
California State Parks and Recreation
National Oceanic and Atmospheric Administration
U.S. Fish and Wildlife Service

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Introduction

During the response to the *T/V Command* spill, 129 Common Murres that are considered to be victims of the spill were recovered on the beaches. Numerous studies have shown that the number of birds recovered subsequent to oil spills represents only a fraction of the actual mortality (see for example Ford et al. 1996). We use the results of previous studies of spills occurring in Northern California and Oregon to estimate the actual murre mortality. We also take into account the steepness and inaccessibility of the coastline in that area which limited the ability of searchers to recover dead and injured birds.

Although no Marbled Murrelet carcasses were recovered during the response to the *Command* spill, it is reasonable to assume that some mortality occurred. Several field studies have demonstrated that small carcasses are rapidly removed from the beach by scavengers, and that small carcasses are often missed by searchers. In evaluating the impacts of the *M/V Kure* and the *M/V New Carissa* on Marbled Murrelet populations, Ford et. al (2002, 2000) estimated that the recovery rates of murrelet carcasses were 6.6% and 4.7% respectively, suggesting that on average only about 1 in 18 dead murrelets would be recovered.

We used a variation on the model used by Ford et. al (2002) to estimate murrelet mortality resulting from the *Command* spill. This model assumes that the proportion of Marbled Murrelets within the affected area that die as a result of oil exposure is the same as the proportion of Common Murres that die. Like Marbled Murrelets, Common Murres are alcids and are highly sensitive to oiling. Murres are usually the most common species recovered subsequent to oil spills on the Pacific Coast of North America, as they are numerous, large-bodied birds whose carcasses are much more likely to be recovered than are those of small birds such as murrelets. Since they tend to die in relatively large numbers during oil spills, murre mortality rates can be estimated with greater confidence than can be done for smaller and rarer species such as murrelets which are recovered much less frequently. The larger body size of murres, however, may also make them less susceptible to the effects of hypothermia resulting from oiling. If this is the case, our estimate of murrelet mortality will be biased in the direction of underestimation.

Marbled Murrelet Mortality Model

We assume that:

1) The proportion of at-risk Marbled Murrelets that become oiled and die is the same as the proportion of at-risk Common Murres that become oiled and die.

2) Live but injured beached birds that are taken to rehabilitation centers would have died without intervention and are treated as dead birds for the purpose of this model.

3) The number of birds at risk of either species within a specified region is proportional to both the density of birds within that region and the size of the region affected by oil.

Based on these assumptions, Murrelet mortality was calculated as follows:

Let:

K be the number of Marbled Murrelets killed.
R be the number of Marbled Murrelets at risk.
K* be the number of Common Murres killed.
R* be the number of Common Murres at risk.

Based on the above assumptions:

$K / R = K^* / R^*$

and

$K = (R K^*) / R$

Birds at Risk

The number of birds at risk (R and R*) was estimated based on data from aerial surveys carried out at the time of the incident. Survey protocol consisted of flying continuous strip transects at an elevation of 200 ft and a speed of 90-100 kt. Two observers, one on either side of the aircraft, counted all birds within a 50m strip. While this technique is very effective for enumerating most species of seabirds, under some lighting conditions it may underestimate the numbers of small dark-plumaged birds such as murrelets.

Data were summarized into 5' latitude x 5' longitude blocks in order to compute densities. For each block, we calculated the length of the survey flightline and the number of murres or murrelets observed in each block. Let:

l be the length of survey flightline within a given 5' block

O be the number of birds observed within that block

w be the width of the transect strip (100 m)

D be the density of birds within the block.

Then:

$D = O / lw$

The number of murres or murrelets at risk was calculated by intersecting each 5' block with a polygon representing the area affected by the oil slick. The number of birds at risk was estimated as the sum of the product of the intersected area and the density of birds for each block.

The affected. area (Fig 1) was estimated using observations of oiling combined with the results of the trajectory modeling (French and Isaji, 1999). We differentiated three polygons within the affected area:

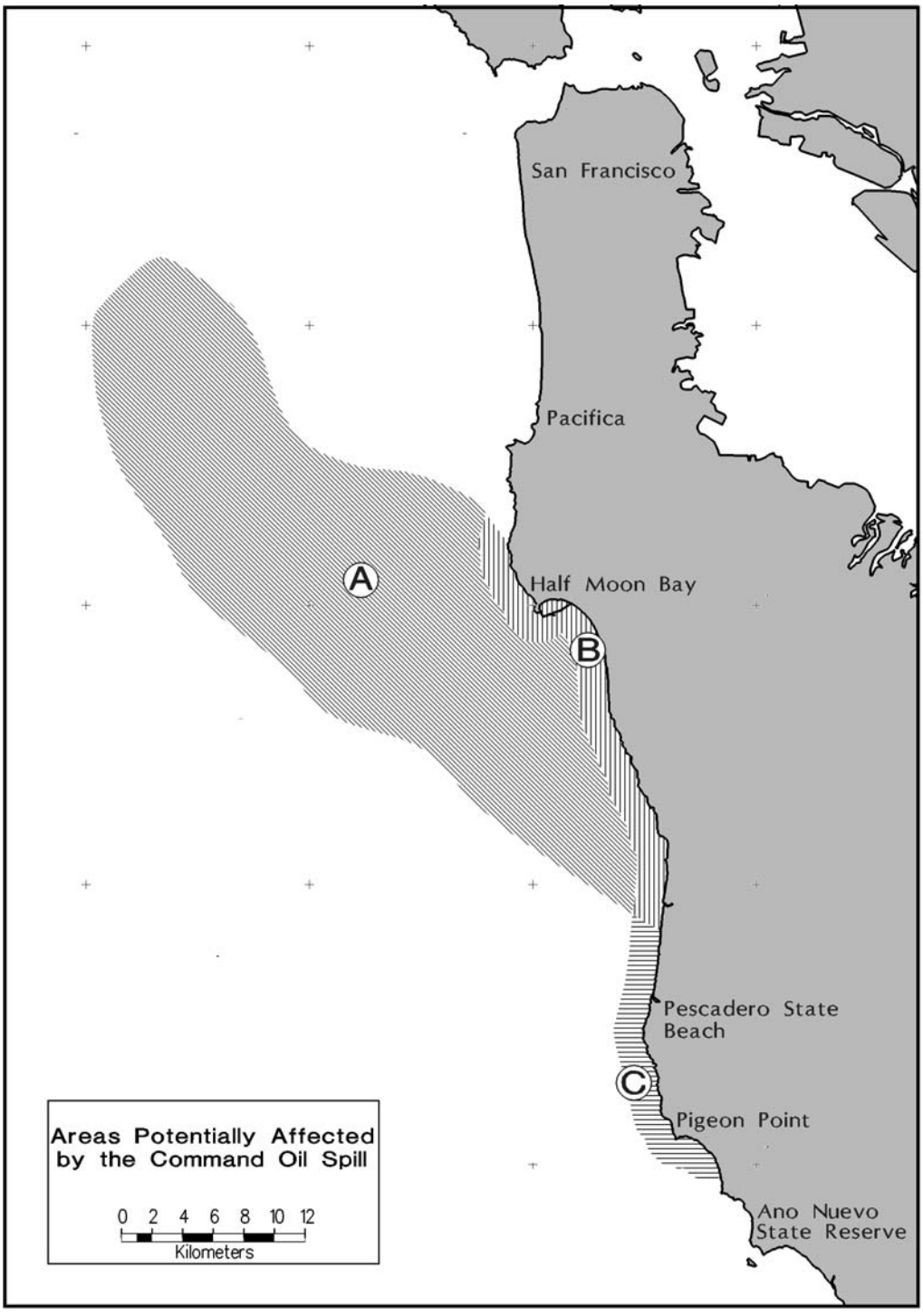

Figure 1. Areas potentially affected by the *Command* oil spill

Area A: The at-sea area affected by the spill to within 2 km of the shoreline.

Area B: The area within 2 km of the shoreline that was affected by the spill based on the hindcast of French and Isaji, extending from about Miramontes Point in the north to Pescadero Creek in the south. This is where most of the tarball deposition was observed.

Area C: The nearshore area extending from the southern boundary of Area B to near Pigeon Point. Oil was not observed offshore in this area, and tarball deposition was light.

The estimated number of Marbled Murrelets at risk within Areas B and C combined was estimated to be 87 birds (murrelets do not occur as far offshore as Area A). The number of Common Murres at risk within Areas A, B and C combined was estimated to be 11,193 birds. A total of 129 Common Murres were recovered, some injured but alive, and some dead. Based on Assumption 2, we use this as the basis of our estimate of murre mortality.

Calculation of Murre Mortality

Much of the coastline in both Area B and Area C where carcass deposition occurred was either inaccessible to searchers or unlikely to retain carcasses. We used the NOAA Environmental Sensitivity Index (Research Planning Institute, 1994) to determine the proportion of the coastline which could be effectively searched. The following table lists the proportion of shoreline falling into various ESI categories for Area B and Area C:

ESI Category	Area B	Area C
Exposed Rock Cliff	24.9%	18.3%
Wave Cut Platform	44.3%	52.9%
Fine Medium Grain Sandy Beach	15.7%	25.6%
Mixed Sand/Gravel Beach	4.0%	1.0%
RipRap	7.0%	0.0%
Sheltered Rocky Shore	0.0%	2.2%
Sheltered Man Made Structure	2.8%	0.0%
Salt Flat	1.4%	0.0%

If it is assumed that Exposed Rock Cliff and Wave Cut Platform were inaccessible and/or had very low carcass retention, then carcasses could only effectively be recovered from 30.8% of Area B and 28.8% of Area C. Using the average value of 29.8%, this implies that the 129 murres recovered represent a total of about 432 murres that would have been recovered along the total coastline of Areas B and C, had it been possible to search all areas.

The percentage of beach-cast murres recovered by beach searchers following the *M/V Kure* and *M/V New Carissa* oil spills were 31.4% and 26.7% respectively, averaging 29.0%. The remaining 71% of murres were removed by scavengers before searchers arrived or were missed by searchers. Using this as our beached bird recovery rate, we estimate that the 432 recoverable murres represent a total of about 1,490 murres that died or would have died without rehabilitation.

Calculation of Murrelet Mortality

Assuming that the proportion of at-risk murrelets that become oiled and die is the same as the proportion of at-risk Common Murres that become oiled and die, we estimate that 6-12 Marbled Murrelets were killed by oil from the *Command* spill. The following summarizes our estimates of murrelet mortality:

Common Murres at risk (**R***)	11,193	Marbled Murrelets at risk (**R**)	87
Common Murres killed (**K***)	1,490	Marbled Murrelets killed (**K**)	12

During the *M/V Kure* spill response, boat-based observers noted that three times as many Common Murres were observed with oiling as were later estimated to have been deposited on the beach during the spill response. It is therefore possible that the level of Marbled Murrelet mortality may in fact have been higher than the estimate based on murre mortality alone. It is also possible that aerial observers did not see all murrelets within their transect strips, which would result in underestimation of murrelet density and mortality. Given that the odds of recovering a murrelet carcass on a searched beach are about 1:18, and that much of the coast in the affected area is inaccessible, it is not surprising that Marbled Murrelets were not recovered during the spill response.

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